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Application Number	10/733,738	RECEIVED
Filing Date	December 11, 2003	CENTRAL FAX CENTER
First Named Inventor	David B. Allen	
Art Unit	1775	MAY 29 2007
Examiner Name	Daniel M. Miller	
Attorney Docket Number	2003P14124US	

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## **GENERAL EXCAVATION**

MAY 29 2007

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<input type="checkbox"/> Amendment/Reply	<input type="checkbox"/> Petition	<input checked="" type="checkbox"/> Appeal Communication to TC (Appeal Notice, Brief, Reply Brief)			
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Amended appeal brief filed in response to the Notification of Non-Compliant Appeal Brief, dated May 1, 2007					
No fees are believed due. Please charge any fee deficiencies or credit any overpayments to Deposit Account No 50-0951					

**SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT**

Firm Name	AKERMAN SENTERFITT		
Signature			
Printed name	Mark M. Zylka		
Date	May 29, 2007	Reg. No	48,518

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Application No. : 10/733,738

Confirmation No.: 8398

Applicant : David B. Allen

Filed : December 11, 2003

TC/AU : 1775

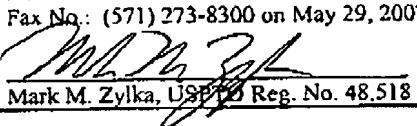
Examiner : Daniel H. Miller

Docket No. : 2003P14124US

For : Turbine Blade Tip With Optimized Abrasive

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Mark M. Zylka, USPTO Reg. No. 48,518**APPEAL BRIEF UNDER 37 C.F.R. § 41.37 (AMENDED)**

The notice of appeal was filed on January 11, 2007. This amended appeal brief is timely filed in response to the Notification of Non-Compliant Appeal Brief, dated May 1, 2007. The Notification indicates that the brief does not contain a concise statement of each ground of rejection presented for review because it "does not indicate claims 16 & 17 under any statute and/or citations." The "Status of Claims" section of the brief has been amended to clarify that claims 16 and 17 are not on appeal, including an indication that the status of these claims is unclear. Because claims 16 and 17 are not on appeal, it is respectfully submitted that it is unnecessary to discuss these claims in the "Grounds of Rejection to be Reviewed on Appeal" and "Argument" sections of the brief. Appellant respectfully submits that the brief, as amended, is in condition for consideration.

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**I. REAL PARTY IN INTEREST**

The real party in interest is Siemens Power Generation, Inc., the assignee of record.

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**II. RELATED APPEALS AND INTERFERENCES**

There are no known related appeals or interferences.

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### III. STATUS OF CLAIMS

Claims 2, 4-7, 9, 10 and 12-18 are pending in the application.

Claims 2, 4-7, 9, 10, 12-15 and 18 stand rejected under 35 U.S.C. § 103.<sup>1</sup> Specifically, claims 2 and 6 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 4,735,656 ("Schaefer"). Claims 4, 5, 7, 9, 10, 12-15 and 18 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Schaefer in view of U.S. Patent No. 6,190,124 ("Freling"). Claims 4, 5, 7, 9, 10, 12-15 and 18 were further rejected under 35 U.S.C. § 103(a) as being unpatentable over Schaefer in view of U.S. Patent No. 6,896,485 ("Ohara").

The status of claims 16 and 17 is unclear. In the "Office Action Summary" section of the final rejection dated August 11, 2006, claims 2 and 4-18 were listed as pending in the application and as being rejected. However, in the "Detailed Action" section, only claims 2, 4-7, 9, 10, 12-15 and 18 are indicated as being rejected; no mention of claims 16 or 17 is made. Appellant believes claims 16 and 17 to be directed to patentable subject matter.

Claims 1, 3, 8 and 11 are canceled.

Claims 2, 4-7, 9, 10, 12-15 and 18 are on appeal.

<sup>1</sup> Appellant notes that the final rejection indicates that claims 2 and 4-18 are rejected. However, in light of the previous cancellation of claims 8 and 11, Appellant understands these claims are not rejected.

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#### IV. STATUS OF AMENDMENTS

No amendments were filed subsequent to the final rejection, dated August 11, 2006. All previous amendments have been entered.

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## **V. SUMMARY OF CLAIMED SUBJECT MATTER**

Aspects of the invention are directed to an optimized abrasive that is used on the tip of a turbine blade. The independent claims recite alternative definitions and arrangements of the invention and are briefly reviewed below.

### **A. Claim 2**

Claim 2 is directed to a turbine blade with abrasive tip coating. A turbine blade (10) is elongated and has a tip (12) at one end. An abrasive coating (18) is provided on the tip (12) of the turbine blade (10). The abrasive coating (18) includes a substantially 50:50 mixture of cubic boron nitride and silicon nitride. See FIG. 1 and specification at page 5, line 4 – page 5, line 9; page 5, line 16 – page 5, line 29; and page 6, line 4 – page 6, line 23.

### **B. Claim 4**

Claim 4 is directed to a turbine blade with abrasive tip coating. A turbine blade (10) is elongated and has a tip (12) at one end. An abrasive coating (18) is provided on the tip (12) of the turbine blade (10). The abrasive coating (18) includes a mixture of cubic boron nitride, silicon nitride and CoNiCrAlY. See FIG. 1 and specification at page 5, line 4 – page 5, line 9; and page 5, line 16 – page 6, line 2.

### **C. Claim 7**

Claim 7 is directed to an assembly that includes an elongated turbine blade (10) and a turbine ring segment (16). The turbine ring segment (16) has an inner surface on which there is an abradable coating (20). The turbine blade (10) has a tip (12) at one end. An abrasive coating (18) is provided on the blade tip (12); this abrasive coating (18) includes a mixture of substantially equal parts of cubic boron nitride and silicon nitride. The abrasive coating (18) engages and abrades the abradable coating (20) of the turbine ring segment (16). See FIG. 1 and

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specification at page 4, line 19 – page 5, line 9; at page 5, line 16 – page 5, line 29; and page 6,  
line 4 – page 6, line 23.

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#### **VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL**

The following grounds of rejection are requested to be reviewed on appeal:

1. Whether claims 2 and 6 are unpatentable under 35 U.S.C. § 103(a) over Schaefer.
2. Whether claims 4, 5, 7, 9, 10, 12-15 and 18 are unpatentable under 35 U.S.C. § 103(a) over Schaefer in view of Freling.
3. Whether claims 4, 5, 7, 9, 10, 12-15 and 18 are unpatentable under 35 U.S.C. § 103(a) over Schaefer in view of Ohara.

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## VII. ARGUMENT

### A. *Whether claims 2 and 6 are unpatentable under 35 U.S.C. § 103(a) over Schaefer*

Claims 2 and 6 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 4,735,656 ("Schaefer"). Claim 2 and its dependent claim 6 will be argued together. While acknowledging that "Schaefer does not specifically teach the amounts of ceramic particles to be added," the Office Action takes the position that it would have been obvious to "use amounts of SiN and cBN that provide the desired abrasiveness to the coating."

Appellant respectfully submits that the invention recited in claim 2 is not obvious in light of Schaefer. The rejection appears to be based on the following paragraph in Schaefer:

Various ceramics may be used, so long as good metal-ceramic adhesion is achieved. For the abrasive materials which are the prime object of the present invention, it is necessary that the ceramic not interact with the metal matrix because this degrades the wear resistance of the ceramic and thus the entirety of the material. Ceramics which are not inherently chemically resistant must be coated as is the silicon carbide. Other essential materials which may or may not be coated with another ceramic and which are within contemplation for high temperature applications include silicon nitrides and the various alloys of such, particularly silicon-aluminum oxynitride, often referred to as SiAlON. Boron nitride is a material that some have favored. Of course, it is feasible to mix such materials. At lower temperature virtually any ceramic may be used, depending on the intended use of the ceramic-metal composite.

Schaefer at col. 6, line 54 – col. 7, line 2.

It is respectfully submitted that the Examiner reads too much into Schaefer. Schaefer merely presents a laundry list of materials. While noting that it is feasible to mix such materials, Schaefer does not specifically call out the claimed combination of cubic boron nitride and silicon nitride. Moreover, Schaefer is completely devoid of any teaching of the relative amounts of such materials.

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However, the Office Action notes that "SiN and cBN have known values of hardness; therefore one of ordinary skill would have found it obvious to vary the amounts to achieve the desired abrasive quality in the coating." Appellant maintains that it would not have been obvious to vary the amounts of cubic boron nitride and silicon nitride to achieve a substantially 50:50 mixture, as recited in claim 2. Further, the focus on the hardness quality of cBN and SiN reveals the flawed formulation the obviousness rejection.

The combination of cubic boron nitride and silicon nitride in claim 2 seeks to maintain a desired hardness while providing greater resistance to thermal degradation in the turbine engine environment. Cubic boron nitride is desirable in abrasive materials because of its proven cutting capability. With the goal of maintaining such cutting capability in mind, one skilled in the art would actually be motivated away from decreasing the relative amount of cubic boron nitride for fear of dramatically reducing the cutting ability of the abrasive material, particularly with a material like silicon nitride that has a lower cutting capability due to its lower hardness.

Specification at page 5, lines 19-20.

The inventor has gone against this conventional thinking by decreasing the relative amount of cubic boron nitride by about half and substituting it with silicon nitride. As noted in the present application, such a mixture was surprising because the initial cutting capability of the mixture was shown to be comparable with a blade tip with 100% cBN. Specification at page 6, lines 15-18. Thus, in going from 100% cBN to a substantially 50:50 mixture of cBN and  $\text{Si}_3\text{N}_4$ , the initial cutting capability of a blade was not substantially sacrificed. Specification at page 6, lines 15-18. Further, a coating with relatively equal amounts of the cubic boron nitride and the silicon nitride has surprisingly proved to effectively retain the benefits of each material system –

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superior cutting properties of the cubic boron nitride and greater resistance to thermal degradation of the silicon nitride. Specification at page 5, lines 26-29.

Schaefer clearly does not appreciate such considerations. Indeed, there is no discussion whatsoever in Schaefer regarding the prevention of thermal degradation while also maintaining the cutting capability of cubic boron nitride. It is only with the benefit of hindsight that one skilled in the art can modify the disclosure of Schaefer to arrive at the preferred mixture. Thus, the disclosure of Schaefer does not render claim 2 obvious.

Appellant would also like to address the Examiner's reliance on the present specification, which notes that relative amounts of the abrasives can be varied to suit the specific engine application. Specification at page 6, lines 5-6. The Office Action indicates that this language "seems to imply that one of ordinary skill would be able to adjust the amount of abrasives based on the desired function." It is respectfully submitted that the Examiner is making the mistake of confusing the specification with the claim. While the present specification notes that may be possible to adjust the relative amounts of cBN and SiN, the language of the claim cannot be disregarded. Claim 2 specifically recites a substantially 50:50 mixture. The present application cannot be used against the patentability of the pending claims and cannot be used as a justification for modifying Schaefer.

Thus, for at least the reasons set forth above, claims 2 and 6 are distinguishable over the cited art and are allowable. Withdrawal of the rejection is requested.

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**B. Whether claims 4, 5, 7, 9, 10, 12-15 and 18 are unpatentable under 35 U.S.C. § 103(a) over Schaefer in view of Freling.**

Among the claims rejected based on Schaefer and Freling, claims 4 and 7 are independent claims. Claims 5 and 18 ultimately depend from claim 4. Claims 4 and 18 will be argued together; claim 5 will be argued separately with additional arguments presented.

Claims 9, 10 and 12-15 ultimately depend from claim 7. Independent claim 7 will be argued together with its dependent claims 9, 10 and 12-15.

**1. Claims 4 and 18**

According to the final Office Action, claim 4 is obvious based on Schaefer, which discloses all of the elements of claim 4, except that it does not teach the additional composition of MCrAlY. The Examiner relies on Freling to supply these deficiencies.

Significantly, neither Schaefer nor Freling disclose the claimed combination of cubic boron nitride, silicon nitride and CoNiCrAlY. Nor is any teaching, suggestion or motivation provided by either reference for using such a mixture in the abrasive coating. Appellant respectfully submits that it is only with the benefit of hindsight of the present invention that one skilled in the art would arrive at the invention recited in claim 4. Thus, the invention recited in claim 4 would not be obvious to one skilled in the art. For at least these reasons, the rejection of claims 4 and 18 based on Schaefer with Freling is not well founded and should be withdrawn.

**2. Claim 5**

Claim 5 recites that the mixture includes substantially equal parts of cubic boron nitride and silicon nitride. In addition to the arguments presented in connection with claim 4 above, Appellant incorporates by reference all of its arguments made in connection with claim 2. Specifically, Schaefer does not disclose such relative amounts of cubic boron nitride and silicon

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nitride nor are such amounts obvious. Further, Freling does not disclose any combination of these materials, let alone relative amounts of these materials. Therefore, for at least these reasons, claim 5 is not obvious based on Schaefer in view of Freling. The rejection of claim 5 should be withdrawn.

### 3. Claims 7, 9, 10 and 12-15

According to the final Office Action, Schaefer teaches all elements of claim 7, except for the "additional compositions of MC<sub>x</sub>Al<sub>y</sub> or specifies the ring segment with which the tip comes into contact." The Examiner relies on Freling to supply the deficiency. Claim 7 recites that the abrasive coating includes a mixture of substantially equal parts of cubic boron nitride and silicon nitride. Such a mixture is not taught by Schaefer, and Appellant incorporates by reference its arguments made in this regard in connection with claim 2 above. Further, Freling does not mention any such combination of cubic boron nitride and silicon nitride, let alone any relative amounts of such materials. Therefore, for at least these reasons, the rejection of claims 7, 9, 10 and 12-15 based on Schaefer with Freling is not well founded and should be withdrawn.

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*C. Whether claims 4, 5, 7, 9, 10, 12-15 and 18 are unpatentable under 35 U.S.C. § 103(a) over Schaeffer in view of Ohara.*

Among the claims rejected based on Schaeffer and Ohara, claims 4 and 7 are independent claims. Claims 5 and 18 ultimately depend from claim 4. Claims 4 and 18 will be argued together; claim 5 will be argued separately with additional arguments presented.

Claims 9, 10 and 12-15 ultimately depend from claim 7. Independent claim 7 will be argued together with its dependent claims 9, 10 and 12-15.

**1. Claims 4 and 18**

According to the final Office Action, claim 4 is obvious based on Schaeffer, which discloses all of the elements of claim 4, except that it does not teach the additional composition of MC<sub>x</sub>CrAlY. The Examiner relies on Ohara to supply these deficiencies.

Significantly, neither Schaeffer nor Ohara disclose the claimed combination of cubic boron nitride, silicon nitride and CoNiCrAlY. Nor is any teaching, suggestion or motivation provided by either reference for using such a mixture in the abrasive coating. Appellant respectfully submits that it is only with the benefit of hindsight of the present invention that one skilled in the art would arrive at the invention recited in claim 4. Thus, the invention recited in claim 4 would not be obvious to one skilled in the art. For at least these reasons, the rejection of claims 4 and 18 based on Schaeffer with Ohara is not well founded and should be withdrawn.

**2. Claim 5**

Claim 5 recites that the mixture includes substantially equal parts of cubic boron nitride and silicon nitride. In addition to the arguments presented in connection with claim 4 above, Appellant incorporates by reference all of its arguments made in connection with claim 2. Specifically, Schaeffer does not disclose such relative amounts of cubic boron nitride and silicon

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nitride nor are such amounts obvious. Further, Ohara does not disclose any combination of these materials, let alone relative amounts of these materials. Therefore, for at least these reasons, claim 5 is not obvious based on Schaefer in view of Ohara. The rejection of claim 5 should be withdrawn.

3. **Claims 7, 9, 10 and 12-15**

According to the final Office Action, Schaefer teaches all elements of claim 7, except for the "additional compositions of MC<sub>x</sub>Al<sub>y</sub> or specifies the ring segment with which the tip comes into contact." The Examiner relies on Ohara to supply the deficiency. Claim 7 recites that the abrasive coating includes a mixture of substantially equal parts of cubic boron nitride and silicon nitride. Such a mixture is not taught by Schaefer, and Appellant incorporates by reference its arguments made in this regard in connection with claim 2 above. Further, Ohara does not mention any such combination of cubic boron nitride and silicon nitride, let alone any relative amounts of such materials. Therefore, for at least these reasons, the rejection of claims 7, 9, 10 and 12-15 based on Schaefer with Ohara is not well founded and should be withdrawn.

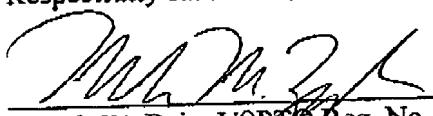
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### VIII. CONCLUSION

For at least the reasons set forth above, appealed claims 2, 4-7, 9, 10, 12-15 and 18 define patentable subject matter over the prior art of record and are thus allowable. The Appellant respectfully requests withdrawal of the rejections and issuance of a Notice of Allowance for these claims.

Respectfully submitted,

Date: 5/29/2007

  
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## XI. CLAIMS APPENDIX

1. (Canceled)
2. (Previously Presented) A turbine blade with abrasive tip coating, comprising: an elongated turbine blade having a tip at one end, said tip having an abrasive coating including a substantially 50:50 mixture of cubic boron nitride and silicon nitride.
3. (Canceled)
4. (Previously Presented) A turbine blade with abrasive tip coating, comprising: an elongated turbine blade having a tip at one end, said tip having an abrasive coating including a mixture of cubic boron nitride, silicon nitride and CoNiCrAlY.
5. (Previously Presented) The turbine blade according to claim 4 wherein the abrasive coating includes substantially equal parts of cubic boron nitride and silicon nitride.
6. (Previously Presented) The turbine blade according to claim 2 wherein the cubic boron nitride and the silicon nitride are electroplated to the blade tip.
7. (Previously Presented) A turbine blade and ring segment assembly, comprising: a turbine ring segment having an abradable coating on an inner surface thereof; an elongated turbine blade having a tip at one end, said blade tip having an abrasive coating, said abrasive coating engaging and abrading said abradable coating of the turbine ring segment; wherein said abrasive coating of said blade tip includes a mixture of substantially equal parts of cubic boron nitride and silicon nitride.
8. (Canceled)

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9. (Original) The assembly according to claim 7 wherein the abrasive coating includes a super alloy of at least one of nickel and cobalt.

10. (Original) The assembly according to claim 9 wherein the super alloy is CoNiCrAlY.

11. (Canceled)

12. (Original) The assembly according to claim 7 wherein the cubic boron nitride and the silicon nitride are electroplated to the blade tip.

13. (Original) The assembly according to claim 7 wherein the abradable material of the ring segment is a thermal barrier coating.

14. (Original) The assembly according to claim 13 wherein the thermal barrier coating is porous.

15. (Original) The assembly according to claim 14 wherein the thermal barrier coating is ceramic.

16. (Original) The assembly according to claim 15 wherein the thermal barrier coating includes yttria-stabilized zirconia (YSZ).

17. (Original) The assembly according to claim 16 wherein the thermal barrier coating includes 8 wt. % YSZ (8YSZ).

18. (Previously Presented) The turbine blade according to claim 4 wherein the abrasive coating is electroplated to the blade tip.

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**X. EVIDENCE APPENDIX**

None

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**XI. RELATED PROCEEDINGS APPENDIX**

None

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